Cat. No. W905-E2-01

SYSMAC C200H-ASC*1
SYSDRIVE 3G3EV, 3G3MV, 3G3JV, 3G3HV & 3G3FV

SYSDRIVE Modbus Master Software

OPERATION MANUAL

OMRON

SYSDRIVE Master

Operation Manual

Produced March 2000

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The following conventions are used to indicate and classify precautions in this manual. Always heed the information provided with them. Failure to heed precautions can result in injury to people or damage to the product.

⚠ DANGER! Indicates information that, if not heeded, is likely to result in loss of life or serious injury.

⚠ WARNING Indicates information that, if not heeded, could possibly result in loss of life or serious injury.

⚠ Caution Indicates information that, if not heeded, could result in relatively serious or minor injury, damage to the product, or faulty operation.

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⚠ **WARNING**	Failure to read and understand the information provided in this manual may result in personal injury or death, damage to the product, or product failure. Please read each section in its entirety and be sure you understand the information provided in the section and related sections before attempting any of the procedures or operations given.

General overview

This section is supposed to give the reader a summary and other global information on this document. It gives an overview of the context and contents of this manual.

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1 About this manual

This manual describes the use of the SYSDRIVE Master Library I/F Application for the C200H-ASC21. With this application, the ASC21 can be used as an interface between a C200H (or CS1) PLC and up to 31 SYSDRIVE inverters. The application supports the SYSDRIVE 3G3JV, 3G3MV, 3G3FV, 3G3EV-AxxxMA and 3G3HV inverters (-CE types only).

The used protocol to communicate is Yaskawa Memobus, which is a variant of Modicon's Modbus RTU (Remote Terminal Unit). The SYSDRIVE Master Application acts as a "master" with the SYSDRIVE inverters behaving as "slaves". The master unit (ASC21) controls communication to a slave unit (SYSDRIVE inverters), whether to read from, or write to, a slave.

Since more than one inverter can be connected, a RS422/485 port is needed and therefore the application is only suitable for the ASC21. Theoretically however, an ASC11/31 can also be used in combination with a RS232-RS422/485 converter.

The manual is divided into three sections:

- Section one explains the installation. It describes how to equip the ASCII unit with the SYSDRIVE Master Library Function Application as well as how to connect the inverter(s) to the ASCII unit.
- Section two describes which part of the memory area in the PLC is used and how it is used.
- Section three explains how to configure the ASCII unit as well as the inverter(s).
- The last section explains the usage of the application.

2 References

When reading this manual or starting writing user library functions, the following documents might be of help:

- W306-E1-2: C200H-ASC11/21/31Operation Manual
- W360-E2-1: ASCII Library I/F Toolkit Operation Manual
- I528-E2-1: 3G3JV User's Manual
- I527-E1-1: 3G3MV User's Manual
- F-Man-3G3FV-PMAN1: 3G3FV Programming Manual
- F-Man-3G3FV-001: 3G3FV Operation Manual
- I013-E1-3: 3G3EV User's Manual
- F-Man-3G3HV-001: 3G3HV Operation Manual

1 Installation

This section explains the installation. It describes how to equip the ASCII unit with the SYSDRIVE Master Application as well as how to connect the inverter(s) to the ASCII unit.

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1-2 Equip the ASCII Unit with the SYSDRIVE Master 2
1-3 Connecting the Inverter(s) to the ASCII unit 2

1-1 Required Equipment

The following is required (see also the C200H-ASC11/21/31 Operation Manual):

- An operating ASC21 unit.
- An “ASCII unit to PC” cable.
- A terminal emulation running on a PC.

1-2 Equip the ASCII Unit with the SYSDRIVE Master

1. From the PC terminal clear all memory as described in section 9-2-1 of the C200H-ASC11/21/31 Operation Manual.
2. Start the prompt of the ASCII unit: power on and press CTRL-X.
3. Libload the library function into the memory of the ASC21:

```
LIBLOAD #1, "COMU:9600,8,N,2,CS_OFF,RS_OFF,DS_OFF,XN_ON";"master",&H30000
[enter]
```

4. Make sure that the port configurations are set properly. Send the library function from the terminal using “Send Text File” from the menu bar. Select the file “SYSMOD.MTS”.
5. After sending, press CTRL-C.
6. Enter the following BASIC program:

```
>
> pgen 1
P1     :                [R/W]      0 bytes
> 10 def libfn master(),int,0
> 20 a=fnmaster()
>
```

1-3 Connecting the Inverter(s) to the ASCII unit

1. Configure the ASC21 and the inverter(s) for the 4-wire connecting method.

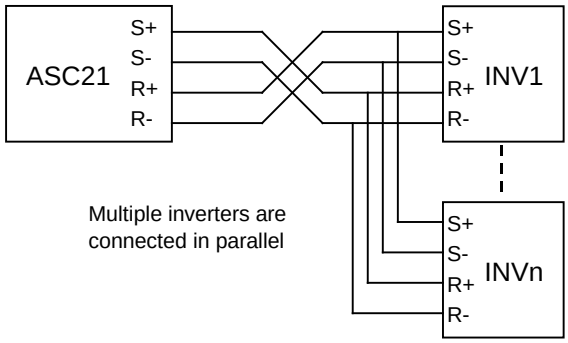
   The following pins are used (see section 2-2-2 of the C200H-ASC11/21/31 Operation Manual for a pin lay-out of port 2):

	ASCII unit port 2	JV inverter	MV inverter	FV inverter	EV inverter	HV inverter
S-	pin 1	pin 2	pin S-	pin 43	pin 2	pin S-
S+	pin 2	pin 4	pin S+	pin 42	pin 4	pin S+
R-	pin 6	pin 5	pin R-	pin 41	pin 5	pin R-
R+	pin 8	pin 1	pin R+	pin 40	pin 1	pin R+

   Remark:

   The JV inverter should be used in combination with the Yaskawa RS485 adapter SI-485/J7. The EV inverter should be used in combination with the OMRON RS485 adapter 3G3EV-PJVOP485. Note that for both adapters in the above table the pin numbers are based on a numbering of the pins from the right side to the left side of the connector.

2. Create a cable to connect the ASCII unit’s S- and S+ to the R- and R+ of the inverter(s) and to connect the ASCII unit’s R- and R+ to the S- and S+ of the inverter(s):



⚠ **Caution** Whilst the SYSDRIVE Inverters can be controlled using the SYSDRIVE Master Application it should be stressed that there should always be a 'hard-wired' connection to the inverter(s) to facilitate an **immediate emergency stop**. Serial communications may be too slow.

2 Memory Map

This section describes which part of the memory area in the PLC is used and how it is used.

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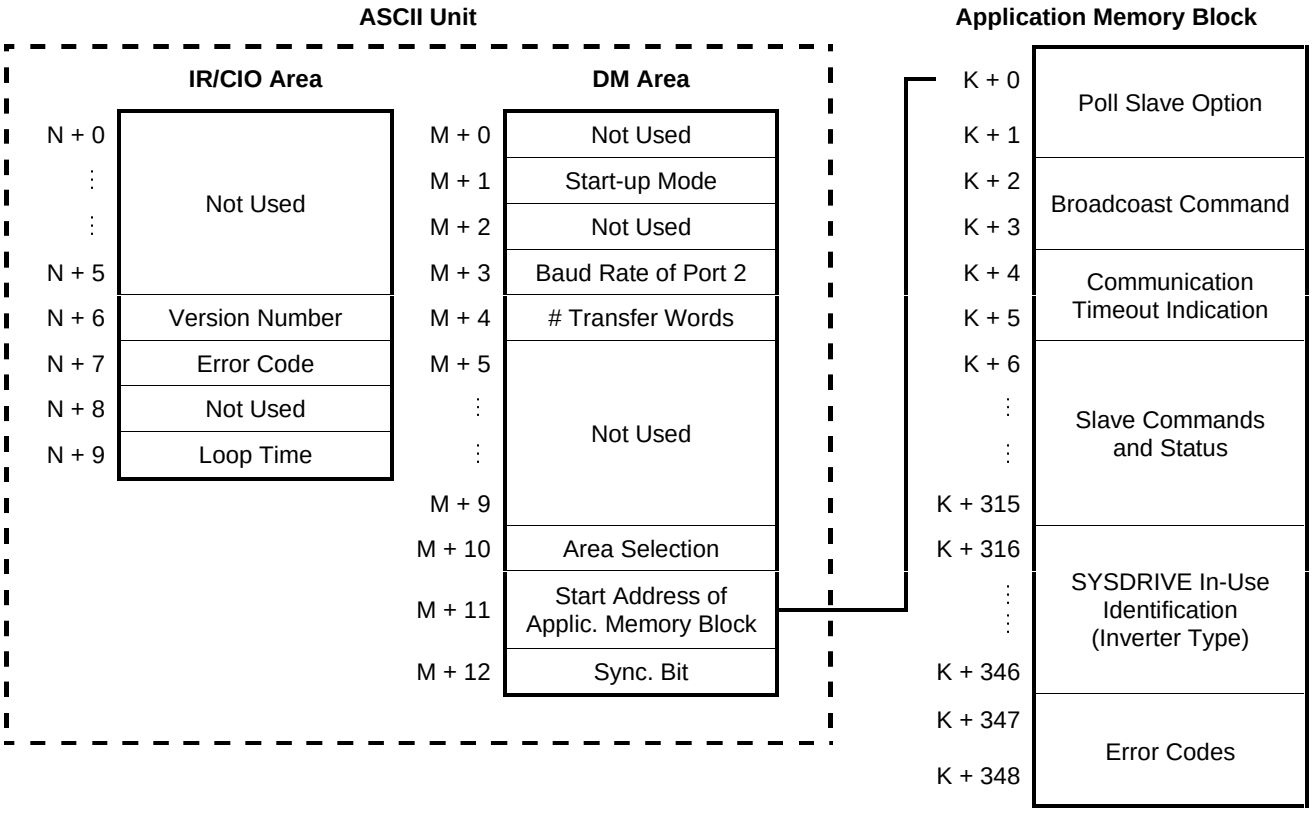
2-1 Overview

The SYSDRIVE Master Application passes information back and forth to the PLC by using a common area of memory. The following part of the memory area in the PLC is used (for more details see sections 2-2 and 3-2):



For C200H PLCs:

N The start-address of the ASCII unit's Internal Relay Memory in the PLC (IR area):

N = 100 + 10 × (unit number) (if unit number is 0, ..., 9)
N = 400 + 10 × (unit number - 10) (if unit number is A, ..., F)

M The start-address of the ASCII unit's Data Memory in the PLC (DM area):

M = 1000 + 100 × (unit number)

K The start-address of the SYSDRIVE Master Application Memory Block in the PLC (DM or EM area):

K = address as stored in M + 11

For CS1 PLCs:

N The start-address of the ASCII unit's Cyclic Input Output Memory in the PLC (CIO area):

N = 2000 + 10 × (unit number)

M The start-address of the ASCII unit's Data Memory in the PLC (DM area):

M = 20000 + 100 × (unit number) (for M + 0, …, M + 9)
M = 1000 + 100 × (unit number) (for M + 10, …, M + 12)

K The start-address of the SYSDRIVE Master Application Memory Block in the PLC (DM or EM area):

K = address as stored in M + 11

2-2 ASCII Unit

2-2-1 IR/CIO Area

Within the ASCII unit's IR/CIO area the following features have been implemented to give some extra information to the user (see also section 3-1 of the C200H-ASC11/21/31 Operation Manual):

IR/CIO address	Description	Valid Values	
N + 6	Application's version number	0100 or higher	
N + 7	Error code Only generated when the application is not correctly configured.	B100	Area Selection Error
		B101	Starting Address Error
		B315	No Slaves Error
		B316	SYSDRIVE In-Use Error for slave 1
		⋮	⋮
		B346	SYSDRIVE In-Use Error for slave 31
		B347	Salve Malfunction Error
N + 9	Loop time	In milliseconds (hexadecimal). E.g. 03E8 means a loop time of 1 second.	

Remarks:

1. In case of an "Area Selection Error" the area selection configured in DM address M + 10 (see section 2-2-2) is invalid.
2. In case of a "Starting Address Error" the Start Address of the Application Memory Block configured in DM address M + 11 (see section 2-2-2) is invalid.
3. In case of a "No Slaves Error", either no inverters are connected, or there are inverters connected but the inverter types specified (i.e. the "SYSDRIVE In-Use for slave x" identification) in DM addresses K + 316 through K + 346 (see section 2-2-2) are all set to "no slave".
4. In case of a "SYSDRIVE In-Use Error for slave x", either the inverter type specified (i.e. the "SYSDRIVE In-Use for slave x" identification) in DM address K + x + 315 (see section 2-2-2) is incorrect/invalid, or the slave is not responding (many possible causes).
5. In case of an "Slave Malfunction Error", DM addresses K + 346 and K + 347 (see section 2-2-2) report which slaves are not functioning, or are not connected properly.

2-2-2 DM Area

The ASCII unit's DM area should be configured in the following way (see also section 3-2-2 of the C200H-ASC11/21/31 Operation Manual):

DM address	Description	Valid Values	Default
M + 1	Start-up mode	005A	---
M + 3	Baud rate of port 2	0: 9,600 1: 300 2: 600 3: 1,200 4: 2,400 5: 4,800 6: 9,600 7: 19,200 8: 38,400	0
M + 4	Number of Transfer Words per cycle (bits 08 to 15)	For C200HX, C200HG, C200HE PLC-types, it is advised to set bits 08 to 15 to the value 5A.	0
M + 10	Area Selection	0: DM 5: EM	---
M + 11	Start address (in BCD) of the application memory block (see section 2-3)	Valid address depends on the PLC-type used.	---
M + 12	Sync. bit	0, 1 A rising edge indicates that the application is ready for operation (i.e. the ladder program is indicated that commands can be given to the application).	---

Remarks:

1. DMA transmission for port 2 (M + 3) is not allowed and must therefore be disabled.
2. To make the application start at power-up, configure M + 1 to 005A and put the START/STOP switch in START position before powering on.
3. For CS1 PLCs M + 10, M + 11 and M + 12 are located in another part of the DM area than M + 1, M + 3 and M + 4 (see section 2-1).

2-3 Application Memory Block

A memory block of 349 words is reserved for the application. This block contains configuration data and is also used as 'shared-memory', used by both the PC and the inverter(s). The memory block is divided into the following groups (for more details see sections 2-3-1 to 2-3-6):

Number of words	Description
2	Poll slave option Of these 32 bits, each bit corresponds to a slave. An extra bit is added to specify "Always Read Slave Data".
2	Broadcast command This command consist of the Operate Signal (1 word) and of the Frequency Reference (1 word). With this command it is possible to broadcast commands to all slaves simultaneously, allowing instantaneous control from all inverters.
2	Communications timeout indication Each bit corresponds to a slave. An extra bit is added for "Don't Poll Slaves" option. With this indication it is notified if a slave has not responded, or a non-expected reply is received.
310	Slave commands and status For each slave 10 words are reserved. The contents of these words differ per inverter type (see sections 2-3-4-1 to 2-3-4-5).
31	SYSDRIVE In-Use identifiers For each slave 1 word is reserved. With the in-use identifiers, the application is configured for different inverter types. The type of inverter in-use must be set to allow correct communication between the SYSDRIVE inverters and the ASC21.
2	Error identification For each slave 1 bit is reserved. Only at start-up, error codes might be generated.

2-3-1 Poll Slave Option

Two words of memory are allocated for the poll slave option:

DM address	Bit	Description	Valid Values
K + 0	00	Poll slave 01	0: Don't poll slave 1: Poll slave
	01	Poll slave 02	
	⋮	⋮	
	15	Poll slave 16	
K + 1	00	Poll slave 17	
	⋮	⋮	
	14	Poll slave 31	
	15	Read all slaves commands	0: Read 1: Don't read

Remarks:

1. No data will be written to, or read from, a slave unless its corresponding poll slave option bit has been set. This data is should be set at the power-up sequence. In case of a communication fault (i.e. the relevant

communications timeout indication bit is set), then the poll slave option data is re-written to the ASC21 unit. This allows a slave to be removed from the network without having to reset the ASC21 unit.

2. If a non-existent slave is polled, then a communications timeout will occur causing slow updates of the data from other slaves. Make sure that only slaves on the network are polled.

3. If none of the poll slave option bits have been set upon power-up then the ASC21 unit is unable to communicate to any SYSDRIVE inverters, resulting with communication timeout indication bits being set. The solution is to set some slaves to be polled. Once at least one poll slave option bit has been set the ASC21 unit will start to poll.

2-3-2 Broadcast Command

Two words of memory are allocated for the broadcast command:

DM address	Bit	Description	Valid Values
K + 2	00	Operate	0: Stop 1: Run
	01	Direction	0: Forward 1: Reverse
	02	Not used	
	03	Not used	
	04	External fault	
	05	Fault reset	
K + 3	Frequency reference		In fixed units of 0 to 7530 Hex (= 30,000 Hz). 0 means the minimal output frequency, while 7530 means 100% output depending upon the maximum output frequency set in the inverter.

Remarks:

1. Data is only broadcast when values have changed in the PLC, being checked before the normal cycle of updating all slaves individually.

2. The communication timeout indication bits signify that a slave has stopped responding to messages. This is generally because an inverter has been turned off, for example to allow for machinery maintenance. Once the inverter is turned back on and responds to messages, the corresponding communication timeout indication bit will be cleared.

2-3-3 Communications Timeout Indication

Two words of memory are allocated for the communications timeout indication:

DM address	Bit	Description	Valid Values
K + 4	00	Slave 01 timeout or communications error	0: No error 1: Error
	01	Slave 02 timeout or communications error	
	⋮	⋮	
	15	Slave 16 timeout or communications error	
K + 5	00	Slave 17 timeout or communications error	
	⋮	⋮	
	13	Slave 30 timeout or communications error	
	14	Slave 31 timeout or communications error	
	15	No poll slave data bit	0: Active slaves 1: No active slaves

2-3-4 Slave Commands and Status

For each slave ten words of memory are allocated for the slave data, five words for the commands and five words for the status:

SYSDRIVE inverter	Command Area DM address (Read/Write)	Status Area DM address (Read)
Slave 01 (n = 1)	K + 6 … K + 10	K + 161 … K + 165
Slave 02 (n = 2)	K + 11 … K + 15	K + 166 … K + 170
⋮	⋮	⋮
Slave 31 (n = 31)	K + 156 … K + 160	K + 311 … K + 315

Remarks:

1. The contents of these words differ per inverter type (see sections 2-3-4-1 to 2-3-4-5).
2. Some constants (e.g. the acceleration time and the deceleration time) within the SYSDRIVE inverter can be changed locally at the inverter as well using the digital operator. These changes will be reflected in the command area of the inverter. These values can only be changed when the inverter is not running and will only be read after powering down and up again the complete set-up.

2-3-4-1 Command and Status Area of JV Inverters

The five words of the command area for JV inverters (where **n** is the slave number (see section 2-3-4)):

DM address	Description		Register	Comment
K + (n * 5) + 1	Operate Signal		0001H	
	Bit	**Function**		
	0	Operate		0: Stop 1: Run
	1	Direction		0: Forward 1: Reverse
	2	External fault		0: No fault 1: Fault
	3	Fault reset		0: No reset 1: Reset
	4	Reserved		
	5	Multi-function input reference 2		
	6	Multi-function input reference 3		
	7	Multi-function input reference 4		
	8	Multi-function input reference 5		
	9 - A	Reserved		
	B – F	Not used		
K + (n * 5) + 2	Frequency Reference		0002H	Resolution: 0.1 Hz (if < 100 Hz) 1 Hz (if ≥ 100 Hz)
K + (n * 5) + 3	Acceleration Time		0110H	Resolution: 0.1 sec. (if < 100 sec.) 1 sec. (if ≥ 100 sec.)
K + (n * 5) + 4	Deceleration Time		0111H	Resolution: 0.1 sec. (if < 100 sec.) 1 sec. (if ≥ 100 sec.)
K + (n * 5) + 5	Not used			

The five words of the status area for JV inverters (where **n** is the slave number (see section 2-3-4)):

DM address	Description		Register	Comment
K + (n * 5) + 156	Status Signal		0020H	
	Bit	**Function**		
	0	Operate		0: Stop 1: Run
	1	Direction		0: Forward 1: Reverse
	2	Inverter operation ready		0: Not ready 1: Ready
	3	Fault		0: No failure 1: Failure
	4	Data setting error		0: No error 1: Error
	5	Multi-function output 1		0: MA off 1: MA on
	6 - 7	Reserved		
	8 – F	Not used		
K + (n * 5) + 157	Fault Status		0021H	
	Bit	**Function**		
	0	Over current (OC)		0: No failure 1: Failure
	1	Over voltage (OV)		0: No failure 1: Failure
	2	Inverter overload (OL2)		0: No failure 1: Failure
	3	Inverter overheat (OH)		0: No failure 1: Failure
	4-6	Not used		
	7	External fault (EF,EFO) Emergency stop (STP)		0: No failure 1: Failure
	8	Hardware fault (Fxx)		0: No failure 1: Failure
	9	Motor overload (OL1)		0: No failure 1: Failure
	10	Over torque detection (OL3)		0: No failure 1: Failure
	11	Not used		
	12	Power loss (UV1)		0: No failure 1: Failure
	13	Control power fault (UV2)		0: No failure 1: Failure
	14	Memobus communications time-over (CE)		0: No failure 1: Failure
	15	Reserved		
K + (n * 5) + 158	Not used			
K + (n * 5) + 159	Output Frequency		0024H	
K + (n * 5) + 160	Output Current		0027H	

2-3-4-2 Command and Status Area of MV Inverters

The five words of the command area for MV inverters (where **n** is the slave number (see section 2-3-4)):

DM address	Description		Register	Comment
K + (n * 5) + 1	Operate Signal		0001H	
	Bit	**Function**		
	0	Operate		0: Stop 1: Run
	1	Direction		0: Forward 1: Reverse
	2	External fault		0: No fault 1: Fault
	3	Fault reset		0: No reset 1: Reset
	4	Multi-function input reference 1		
	5	Multi-function input reference 2		
	6	Multi-function input reference 3		
	7	Multi-function input reference 4		
	8	Multi-function input reference 5		
	9	Multi-function input reference 6		
	A	Multi-function input reference 7		
	B – F	Not used		
K + (n * 5) + 2	Frequency Reference		0002H	Resolution: 0.01 Hz
K + (n * 5) + 3	Acceleration Time		0113H	Resolution: 0.1 sec.
K + (n * 5) + 4	Deceleration Time		0114H	Resolution: 0.1 sec.
K + (n * 5) + 5	Not used			

The five words of the status area for MV inverters (where **n** is the slave number (see section 2-3-4)):

DM address	Description		Register	Comment
K + (n * 5) + 156	Status Signal		0020H	
	Bit	**Function**		
	0	Operate		0: Stop 1: Run
	1	Direction		0: Forward 1: Reverse
	2	Inverter operation ready		0: Not ready 1: Ready
	3	Fault		0: No failure 1: Failure
	4	Data setting error		0: No error 1: Error
	5	Multi-function output 1		0: MA off 1: MA on
	6	Multi-function output 2		0: P1 off 1: P1 on
	7	Multi-function output 3		0: P2 off 1: P2 on
	8 – F	Not used		
K + (n * 5) + 157	Fault Status		0021H	
	Bit	**Function**		
	0	Over current (OC)		0: No failure 1: Failure
	1	Over voltage (OV)		0: No failure 1: Failure
	2	Inverter overload (OL2)		0: No failure 1: Failure
	3	Inverter overheat (OH)		0: No failure 1: Failure
	4 - 6	Not used		
	7	External fault (EF,EFO) Emergency stop (STP)		0: No failure 1: Failure
	8	Hardware fault (Fxx)		0: No failure 1: Failure
	9	Motor overload (OL1)		0: No failure 1: Failure
	10	Over torque detection (OL3)		0: No failure 1: Failure
	11	Not used		
	12	Power loss (UV1)		0: No failure 1: Failure
	13	Control power fault (UV2)		0: No failure 1: Failure
	14	Memobus communications time-over (CE)		0: No failure 1: Failure
	15	Operator connection (OPR)		0: No failure 1: Failure
K + (n * 5) + 158	Not used			
K + (n * 5) + 159	Output Frequency		0024H	
K + (n * 5) + 160	Output Current		0027H	

2-3-4-3 Command and Status Area of FV Inverters

The five words of the command area for FV inverters (where **n** is the slave number (see section 2-3-4)):

DM address	Description		Register	Comment
K + (n * 5) + 1	Operate Signal		0000H	
	Bit	**Function**		
	0	Operate		0: Stop 1: Run Forward
	1	Direction		0: Stop 1: Run Reverse
	2	Multi-function input reference 3		
	3	Multi-function input reference 4		
	4	Multi-function input reference 5		
	5	Multi-function input reference 6		
	6	Multi-function input reference 7		
	7	Multi-function input reference 8		
	8 – F	Not used		
K + (n * 5) + 2	Frequency Reference		0001H	Resolution: 0.01 Hz
K + (n * 5) + 3	Acceleration Time		0200H	Resolution: 0.1 sec.
K + (n * 5) + 4	Deceleration Time		0201H	Resolution: 0.1 sec.
K + (n * 5) + 5	Not used			

The five words of the status area for FV inverters (where **n** is the slave number (see section 2-3-4)):

DM address	Description		Register	Comment
K + (n * 5) + 156	Status Signal		0010H	
	Bit	**Function**		
	0	Operate		0: Stop 1: Run
	1	Speed		0: Not zero speed 1: Zero speed
	2	Direction		0: Forward 1: Reverse
	3	Fault reset		0: No reset 1: Reset
	4	Acceleration		0: Not at speed 1: At speed
	5	Inverter operation ready		0: Not ready 1: Ready
	6	Minor fault		0: No failure 1: Failure
	7	Major fault		0: No failure 1: Failure
	8 – F	Not used		
K + (n * 5) + 157	Fault Status		0014H	
	Bit	**Function**		
	0	Fuse blown (FU)		0: No failure 1: Failure
	1	Main circuit under voltage (UV1)		0: No failure 1: Failure
	2	Control circuit under voltage (UV2)		0: No failure 1: Failure
	3	Main circuit fault (UV3)		0: No failure 1: Failure
	4	Short circuit (SC)		0: No failure 1: Failure
	5	Ground fault (GOC)		0: No failure 1: Failure
	6	Over current (OC)		0: No failure 1: Failure
	7	Over voltage (OV)		0: No failure 1: Failure
	8	Inverter overheat (OH)		0: No failure 1: Failure
	9	Inverter overheat (OH1)		0: No failure 1: Failure
	10	Motor overload (OL1)		0: No failure 1: Failure
	11	Inverter overload (OL2)		0: No failure 1: Failure
	12	Over torque 1 detect (OL3)		0: No failure 1: Failure
	13	Over torque 2 detect (OL4)		0: No failure 1: Failure
	14	Brake transistor fault (RR)		0: No failure 1: Failure
	15	Brake resistor overheat (RH)		0: No failure 1: Failure
K + (n * 5) + 158	Minor Fault		0019H	
	Bit	**Function**		
	0	Under voltage (UV)		0: No failure 1: Failure
	1	Over voltage (OV)		0: No failure 1: Failure
	2	Inverter overheat (OH)		0: No failure 1: Failure
	3	Inverter overheat alarm (OH2)		0: No failure 1: Failure

	4	Over torque 1 detect (OL3)		0: No failure 1: Failure
	5	Over torque 2 detect (OL4)		0: No failure 1: Failure
	6	2 wire sequence input fault (EF)		0: No failure 1: Failure
	7	External base block (BB)		0: No failure 1: Failure
	8	External fault 3 (EF3)		0: No failure 1: Failure
	9	External fault 4 (EF4)		0: No failure 1: Failure
	10	External fault 5 (EF5)		0: No failure 1: Failure
	11	External fault 6 (EF6)		0: No failure 1: Failure
	12	External fault 7 (EF7)		0: No failure 1: Failure
	13	External fault 8 (EF8)		0: No failure 1: Failure
	14	Cooling fan fault (FAN)		0: No failure 1: Failure
	15	Over speed (OS)		0: No failure 1: Failure
K + (n * 5) + 159	Output Frequency		0021H	
K + (n * 5) + 160	Output Current		0022H	

2-3-4-4 Command and Status Area of EV Inverters

The five words of the command area for –AxxxMA type EV inverters (where **n** is the slave number (see section 2-3-4)):

DM address	Description		Register	Comment
K + (n * 5) + 1	Operate Signal		0001H	
	Bit	**Function**		
	0	Operate		0: Stop 1: Run
	1	Direction		0: Forward 1: Reverse
	2	External fault		0: No fault 1: Fault
	3	Fault reset		0: No reset 1: Reset
	4	Multi-function input reference 1		
	5	Multi-function input reference 2		
	6	Multi-function input reference 3		
	7 – F	Not used		
K + (n * 5) + 2	Frequency Reference		0002H	Resolution: 0.1 Hz (if < 100 Hz) 1 Hz (if ≥ 100 Hz)
K + (n * 5) + 3	Acceleration Time		0114H	Resolution: 0.1 sec. (if < 100 sec.) 1 sec. (if ≥ 100 sec.)
K + (n * 5) + 4	Deceleration Time		0115H	Resolution: 0.1 sec. (if < 100 sec.) 1 sec. (if ≥ 100 sec.)
K + (n * 5) + 5	Not used			

The five words of the status area for EV inverters (where **n** is the slave number (see section 2-3-4)):

DM address	Description		Register	Comment
K + (n * 5) + 156	Status Signal		0020H	
	Bit	**Function**		
	0	Operate		0: Stop 1: Run
	1	Direction		0: Forward 1: Reverse
	2	Inverter operation ready		0: Not ready 1: Ready
	3	Fatal fault		0: No failure 1: Failure
	4	Data setting error		0: No error 1: Error
	5	Multi-function output 2		0: P1 off 1: P1 on
	6	Multi-function output 3		0: P2 off 1: P2 on
	7 – F	Not used		
K + (n * 5) + 157	Fault Status		0021H	
	Bit	**Function**		
	0	Over current (OC)		0: No failure 1: Failure
	1	Over voltage (OV)		0: No failure 1: Failure
	2	Inverter overload (OL2)		0: No failure 1: Failure
	3	Inverter overheat (OH)		0: No failure 1: Failure
	4 - 6	Not used		
	7	External fault (EFx)		0: No failure 1: Failure
	8	Hardware fault (CPFxx)		0: No failure 1: Failure
	9	Motor overload (OL1)		0: No failure 1: Failure
	10	Over torque detection (OL3)		0: No failure 1: Failure
	11	Not used		
	12	Power loss (UV1)		0: No failure 1: Failure
	13	Control power fault (UV2)		0: No failure 1: Failure
	14	Transmission fault (BUS)		0: No failure 1: Failure
	15	Not used		
K + (n * 5) + 158	Not used			
K + (n * 5) + 159	Output Frequency		0024H	
K + (n * 5) + 160	Output Current		0027H	

2-3-4-5 Command and Status Area of HV Inverters

The five words of the command area for HV inverters (where **n** is the slave number (see section 2-3-4)):

DM address	Description		Register	Comment
K + (n * 5) + 1	Operate Signal		0001H	
	Bit	**Function**		
	0	Operate		0: Stop 1: Run
	1	Direction		0: Forward 1: Reverse
	2	External fault		0: No fault 1: Fault
	3	Fault reset		0: No reset 1: Reset
	4	Multi-function input reference 1		
	5	Multi-function input reference 2		
	6	Multi-function input reference 3		
	7	Multi-function input reference 4		
	8 – F	Not used		
K + (n * 5) + 2	Frequency Reference		0002H	Resolution: 0.1 Hz (if < 100 Hz) 1 Hz (if ≥ 100 Hz)
K + (n * 5) + 3	Acceleration Time		0113H	Resolution: 0.1 sec. (if < 100 sec.) 1 sec. (if ≥ 100 sec.)
K + (n * 5) + 4	Deceleration Time		0114H	Resolution: 0.1 sec. (if < 100 sec.) 1 sec. (if ≥ 100 sec.)
K + (n * 5) + 5	Not used			

The five words of the status area for HV inverters (where **n** is the slave number (see section 2-3-4)):

DM address	Description		Register	Comment
K + (n * 5) + 156	Status Signal		0020H	
	Bit	**Function**		
	0	Operate		0: Stop 1: Run
	1	Direction		0: Forward 1: Reverse
	2	Inverter operation ready		0: Not ready 1: Ready
	3	Fatal fault		0: No failure 1: Failure
	4	Data setting error		0: No error 1: Error
	5	Multi-function output 2		0: MA-MC off 1: MA-MC on
	6	Multi-function output 3		0: M1-M2 off 1: M1-M2 on
	7 – F	Not used		
K + (n * 5) + 157	Fault Status		0021H	
	Bit	**Function**		
	0	Over current (OC) Ground Fault (GF) Load short circuit (SC)		0: No failure 1: Failure
	1	Over voltage (OV)		0: No failure 1: Failure
	2	Inverter overload (OL2)		0: No failure 1: Failure
	3	Inverter overheat (OH1, OH2)		0: No failure 1: Failure
	4	Not used		
	5	Main circuit fault (PUF)		0: No failure 1: Failure
	6	Not used		
	7	External fault (EF0, EF3 - EF6)		0: No failure 1: Failure
	8	Hardware fault (CPFxx)		0: No failure 1: Failure
	9	Motor overload (OL1, OL3)		0: No failure 1: Failure
	10	Not used		
	11	During under voltage		0: No failure 1: Failure
	12	Power loss (UV1, UV2, UV3)		0: No failure 1: Failure
	13	Output open phase (SP0) Excessive ripple in bus bar (input phase) (SP1)		0: No failure 1: Failure
	14	Braking transistor fault (RR) Overheat (RH)		0: No failure 1: Failure
	15	Reserved		
K + (n * 5) + 158	Not used			
K + (n * 5) + 159	Output Frequency		0024H	
K + (n * 5) + 160	Output Current		0027H	

2-3-5 SYSDRIVE In-Use Identification

For each slave one word of memory is allocated for the SYSDRIVE in-use identification:

DM address	Description	Valid values
K + 316	SYSDRIVE in-use identification for slave 01	0: No inverter 1: JV inverter 2: MV inverter 3: FV inverter 4: EV inverter 5: HV inverter
K + 317	SYSDRIVE in-use identification for slave 02	
⋮	⋮	
K + 346	SYSDRIVE in-use identification for slave 31	

Remark:

Values set other than the valid values / types will mean that the relevant communication timeout indication bit (see section 2-3-3) will be set if the corresponding poll slave option bit (see section 2-3-1) is set. To resolve this problem make sure a valid value has been used and set the corresponding poll slave option bit. Then reset the ASC21 unit to make the SYSDRIVE in-use identification data is read again.

2-3-6 Error Codes

Two words of memory are allocated for error identification, one bit for each slave:

DM address	Bit	Description	Valid Values
K + 347	00	Not used	0: No error 1: Error
	01	Slave 01 malfunction	
	⋮	⋮	
	15	Slave 15 malfunction	
K + 348	00	Slave 16 malfunction	
	⋮	⋮	
	15	Slave 31 malfunction	

3 Configuration

This section explains how to configure the ASCII unit as well as the inverter(s).

3-1 Configuration of the ASCII Unit....26
3-2 Configuration of the Inverters....26
3-2-1 Communication Parameters for JV Inverters....26
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3-1 Configuration of the ASCII Unit

The ASCII unit's Data Memory in the PLC (DM area) should be configured as described in section 2-2-2.

3-2 Configuration of the Inverters

To allow a SYSDRIVE inverter to communicate using the SYSDRIVE Master Application some settings need to be modified from the default factory settings. Other communication parameters like the slave address should be set correctly as well. For more details see sections 3-2-1 to 3-2-5.

As the Yaskawa Memobus protocol is being used, the number of data bits is fixed at 8. There is no parity bit and one stop bit.

The baud rate set for the ASCII unit (in DM address M + 3; see section 2-2-2) should correspond with the baud rate set in all the inverter(s).

Most inverters have a safety feature called "Communications Time-over Detection" (also called "Communications Fault Detection" or "Ceased Communications Detection") which means that if the serial communication is dead for approximately two seconds, the inverters will go into error mode. For this application, it is advised to give the parameter to configure this feature the value "warning only". Configured this way, inverters can still be controlled with Modbus commands even if the inverter has given a communication error.

⚠ **Caution** After changing the inverter communication parameters the complete set-up first need to be powered down and powered up before the new values are read.

3-2-1 Communication Parameters for JV Inverters

Parameter	Description	Register	Valid values	Set value
n02	Run Command Selection	0102H	0: Via digital operator 1: Via multi-function input terminal 2: Via serial communication	2
n03	Frequency Reference Input Selection	0103H	0: Via digital operator 1: Via reference 1 2: Via control terminal for 0-10 V 3: Via control terminal for 4-20 mA 4: Via control terminal for 0-20 mA 6: Via serial communication	6
n68	Communications Time-over Detection Selection	0144H	0: Coast to stop 1: Ramp to stop with decel. time 1 2: Ramp to stop with decel. time 2 3: Warning only 4: No detection	3
n70	Slave Address	0146H	0: Broadcast only 1 - 32: Slave address	--
n71	Communication Baud Rate	0147H	0: 2,400 1: 4,800 2: 9,600 3: 19,200	As set in M + 3
n72	Parity Selection	0148H	0: Even 1: Odd 2: None	2
n74	RTS Control Selection	014AH	0: Enabled 1: Disabled	1

For more information see the 3G3JV User's Manual.

3-2-2 Communication Parameters for MV Inverters

Parameter	Description	Register	Valid values	Set value
n003	Run Command Selection	0103H	0: Via digital operator 1: Via multi-function input terminal 2: Via serial communication 3: Via option	2
n004	Frequency Reference Input Selection	0104H	0: Via digital operator 1: Via reference 1 2: Via control terminal for 0-10 V 3: Via control terminal for 4-20 mA 4: Via control terminal for 0-20 mA 5: Via pulse train reference control 6: Via serial communication 7: Via multi-function for 0-10 V 8: Via multi-function for 4-20 mA 9: Via option	6
n151	Communications Time-over Detection Selection	0197H	0: Coast to stop 1: Ramp to stop with decel. time 1 2: Ramp to stop with decel. time 2 3: Warning only 4: No detection	3
n153	Slave Address	0199H	0: Broadcast only 1 - 32: Slave address	--
n154	Communication Baud Rate	019AH	0: 2,400 1: 4,800 2: 9,600 3: 19,200	As set in M + 3
n155	Parity Selection	019BH	0: Even 1: Odd 2: None	2
n157	RTS Control Selection	019DH	0: Enabled 1: Disabled	1

For more information see Chapter 7 of the 3G3MV User's Manual.

3-2-3 Communication Parameters for FV Inverters

Parameter	Description	Valid values	Set value
B1 - 01	Run Command Selection	--	2
B1 - 02	Frequency Reference Input Selection	--	2
H5 - 01	Slave Address	1 - 31	--
H5 - 02	Communication Baud Rate	0: 1,200 1: 2,400 2: 4,800 3: 9,600	As set in M + 3
H5 - 03	Parity Selection	0: None 1: Even 2: Odd	0
H5 - 04	Communications Time-over Detection Selection	0: Ramp to stop with decel. time 1 1: Coast to stop 2: Ramp to stop with decel. time 2 3: Warning only	3

For more information see section "Group H" of the 3G3FV Programming Manual.

3-2-4 Communication Parameters for EV Inverters

Parameter	Description	Register	Valid values	Set value
n02	Run Command Selection (Frequency Reference Input Selection)	0102H	0: Via digital operator (via digital operator) 1: Via terminal (via dig. operator) 2: Via digital operator (via terminal (voltage signal)) 3: Via terminal (via terminal (voltage signal)) 4: Via digital operator (via terminal (current signal)) 5: Via terminal (via terminal (current signal)) 6: Via digital operator (via serial communication) 7: Via terminal (via serial comm.) 8: Via serial comm. (via digital operator) 9: Via serial comm. (via terminal (voltage signal)) 10: Via serial comm. (via terminal (current signal)) 11: Via serial communication (via serial communication)	11
n66	Communications Time-over Detection Selection	0142H	0: Coast to stop 1: No detection 2: Ramp to stop with decel. time 2	1
n71	Communication Baud Rate	0147H	0: 2,400 1: 4,800 2: 9,600 3: 19,200	As set in M + 3
n74	Parity Selection	014AH	0: Even 1: Odd 2: None	2
n82	RTS Control Selection	0152H	0: Enabled 1: Disabled	1
n83	Slave Address	0153H	0: Broadcast only 1 - 31: Slave address	--

For more information see the 3G3EV User's Manual.

3-2-5 Communication Parameters for HV Inverters

Parameter	Description	Register	Valid values	Set value
n002	Run Command Selection (Frequency Reference Input Selection)	0102H	0: Via digital operator (via digital operator) 1: Via terminal (via digital operator) 2: Via digital operator (via terminal) 3: Via terminal (via terminal) 4: Via digital operator (via serial communication) 5: Via terminal (via serial com.) 6: Via serial communication (via serial communication) 7: Via serial communication (via digital operator) 8: Via serial communication (via terminal)	6
n104	Communications Time-over Detection Selection	0168H	0: Ramp to stop with decel. time 1 1: Coast to stop 2: Ramp to stop with decel. time 2 3: Warning only	3
n106	Slave Address	016AH	0: Broadcast only 1 - 32: Slave address	--
n107	Communication Baud Rate	016BH	0: 2,400 1: 4,800 2: 9,600	As set in M + 3
n108	Parity Selection	016CH	0: None 1: Even 2: Odd	0

For more information see the 3G3HV Operation Manual

4 Using the Application

This section explains the usage of the SYSDRIVE Master Library Function Application.

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4-2 Operation of the Application....32
4-3 How to Give Commands to a Slave....33
4-4 Example....33
4-5 LED Indicators on the ASCII Unit....34

4-1 Starting the SYSDRIVE Master Application

To start the application perform theses actions in the following order:

1. Start the application by either of the following:
   - Using the PC terminal, type RUN and press [enter] from the basic prompt.
   - Switch the START/STOP switch on the ASCII unit from the STOP to the START position.
   - Configure the ASCII unit to auto-start at power-on (see section 2-2-2), power off and put the START/STOP switch in the START position. At power-on, the application will start automatically.
2. Then start the inverters.

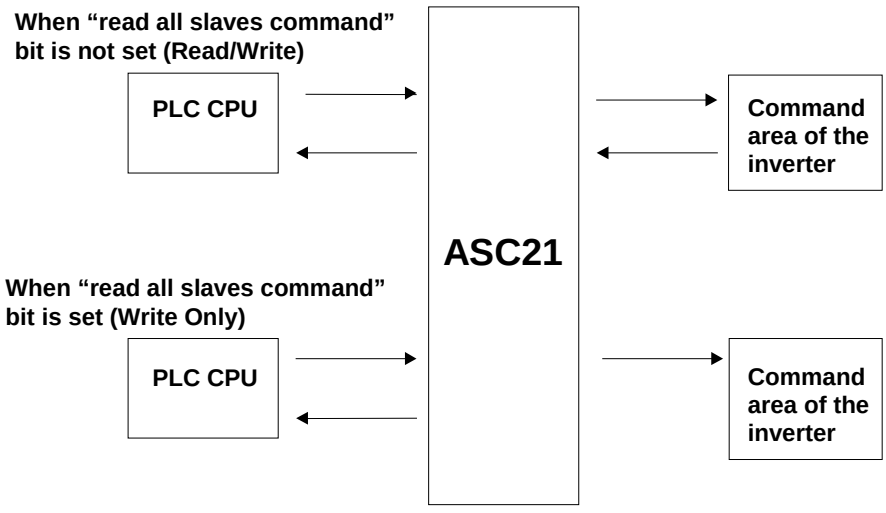
4-2 Operation of the Application

The actions performed by the application:

- At start-up, the configuration data (see sections 3-1 and 3-2) is read. It contains the 31 SYSDRIVE in-use identification words (see section 2-3-5).
- Secondly the configuration is checked. When an inverter doesn't respond that it is ready for use, an error is reported and the application will attempt again until all configured slaves are communicating properly.
- When the initialisation phase of the application is completed, the "Sync. Bit" in the DM area of the ASCII unit (see section 2-2-2) will be set to inform the user (the ladder program) that the application is ready to go.
- All properly configured slaves are serviced in sequence, starting with the first slave in use. When the last slave has been serviced, the loop time is calculated and the loop restarts with the first slave etc.

When a slave is serviced, the contents of the frequency, the run command, the acceleration time and the deceleration time inside registers of the inverter (see section 2-3-4) and the inside memory of the PC are being updated. It is possible to change the command data in the PLC memory so that when the concerning slave is being serviced, its data is changed. In other words, a command is given from the PLC to the inverter.

The other way around is also possible. If a user changes registers inside the inverter manually, its new values can be notified to the PLC the next time the slave is being serviced. So, in that way each cycle all data is monitored from the inverter and reflected at the PLC. If the user is not likely to make changes at the inverter and requires a quicker response for all other communications from the network of inverters sending data in this direction can be disabled by setting the "read all slaves commands" bit (see section 2-3-1) to one. This will speed up the loop time:


When "read all slaves command" bit is not set (Read/Write)
PLC CPU
Command area of the inverter
ASC21
When "read all slaves command" bit is set (Write Only)
PLC CPU
Command area of the inverter

At the end of each “slave service”, the new status of the inverter is written back to the PLC memory. If a slave is not responding, the corresponding “communications timeout identification” bit is set in the DM area (see section 2-2-2).

Slaves can (temporarily) be disabled or put in stand-by mode. This is done with the corresponding “poll slave option” bits (see section 2-3-1). When a slave is disabled, the other slaves that are in use can be serviced more frequently. The status of a disabled slave is still updated in the PLC memory.

4-3 How to Give Commands to a Slave

Commands can be given to inverters using either a broadcast command (see section 2-3-2), or by changing the values in the DM area at those addresses that correspond to the slave (see section 2-3-4). E.g. to give a command to slave 2, change the values in DM addresses K + 11 to K + 15.

4-4 Example

This example describes a configuration in which the ASC21 is connected to two inverters. The first inverter is an FV inverter and it’s slave number is 2. The other inverter is an MV inverter and it’s slave number is 5. The ASCII unit’s unit number (machine number) is 1.

Configuring the application for C200H PLCs:

1. Machine number is 1, so as described in section 2-1: M = 1100. Therefore, set the following values in the following DM addresses (see section 2-2-2):

   DM 1103 = 0
   DM 1104 = 5A00

2. It is desired to put the configuration data in the memory block starting from DM address 0300. Therefore, set the following values in the following DM addresses (see section 2-2-2):

   DM 1110 = 0 (DM area)
   DM 1111 = 0300

3. Tell the application which slaves are in use (see section 2-3-5):

   DM 0616 = 0 (with 616 = 300 + 316)
   DM 0617 = 3 (slave 2 is a FV inverter)
   DM 0618 = 0
   DM 0619 = 0
   DM 0620 = 2 (slave 5 is a MV inverter)
   DM 0621 = 0
   ⋮
   DM 0646 = 0

4. To have the slaves being serviced completely every cycle, set the corresponding bits in the DM addresses 0300 and 0301 (see section 2-3-1):

   DM 0300 = 12 (only slave numbers 2 and 5 are in use)
   DM 0301 = 8000

5. During operation, the following memory blocks can be used (see sections 2-3-2 and 2-3-4):

   DM 0302 – DM 0303 (to set the broadcast command)
   DM 0311 – DM 0315 (to set commands for slave 2)
   DM 0326 – DM 0330 (to set commands for slave 5)
   DM 0466 – DM 0470 (to read the status of slave 2)
   DM 0481 – DM 0485 (to read the status of slave 5)

6. Machine number is 1, so as described in section 2-1: N = 110. Therefore, the following IR addresses can be used:

IR 0116	(to read the application's version number)
IR 0117	(to read the error code)
IR 0119	(to monitor the loop time)

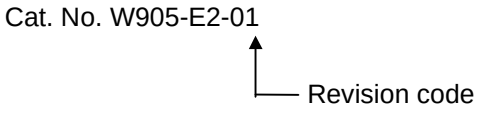
4-5 LED Indicators on the ASCII Unit

The LED indicators on the front of the ASC21 unit are used to represent the following:

RUN:	Illuminated means that the ASC21 unit has been recognised by the PLC CPU (that is, an I/O table has been created).
BASIC:	Illuminated all the time means that the ASC21 unit is running the SYSDRIVE Master Application. If flashing, the ASC21 unit is waiting to be run.
Port 2 T/R:	Signifies data transfer to the SYSDRIVE inverters and should be continuous flashing. If the ASC21 unit has been started and there are regular pulses of light with a short break (0.2 sec.) of no illumination, then a request has been made, but no data has been returned. Check the wiring.
Port 2 Err:	A reception error (parity error, reception buffer overflow, etc.) has occurred at communication port 2.
ASCII Err:	Illuminated means that there is an area selection error, or a starting address error, or a no slaves error, or a SYSDRIVE in-use error, or a slave malfunction error (see section 2-2-1).

Revision History

A manual revision code appears as a suffix to the catalog number on the front cover of the manual.



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